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Torma et al.

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[54] **STEAM-GENERATING DEVICE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **38/104**; 68/222; 122/11

[58] **Field of Search** ..... 38/16, 1 A, 77.1, 38/77.5, 77.83, 77.8, 107, 104; 392/386, 394, 399; 223/51, 70, 76; 122/11, 29, 508; 237/67; 417/207, 208; 68/222

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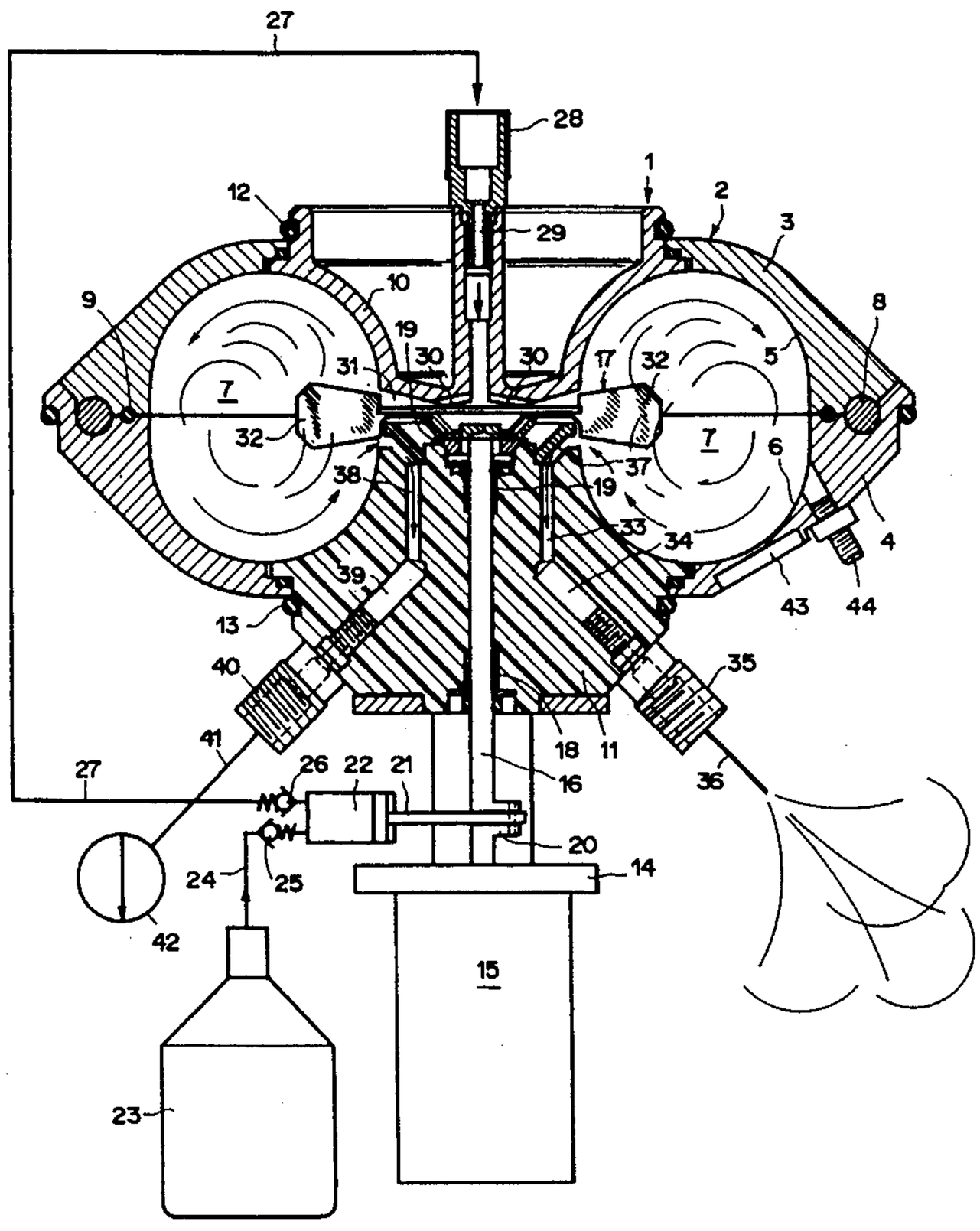
Attorney, Agent, or Firm—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

[57] **ABSTRACT**

A device includes a heating body and a steam-chamber head which form the housing for a steam chamber. The inside walls of the heating body and of the steam-chamber head form an annular steam chamber. An impeller is disposed in the steam chamber as a rotary component. Via a feed supply line, water is supplied to the steam chamber in the vicinity of the vanes of the impeller. By way of the rapidly rotating impeller, the water is atomized into tiny droplets and reaches the hot wall of the steam chamber, where the droplets are vaporized. Good heat transmission and quick evaporation are made possible, i.e., a large amount of steam can reach the consuming appliance via a steam connection within a short time. The scale deposited can easily be removed.

14 Claims, 5 Drawing Sheets



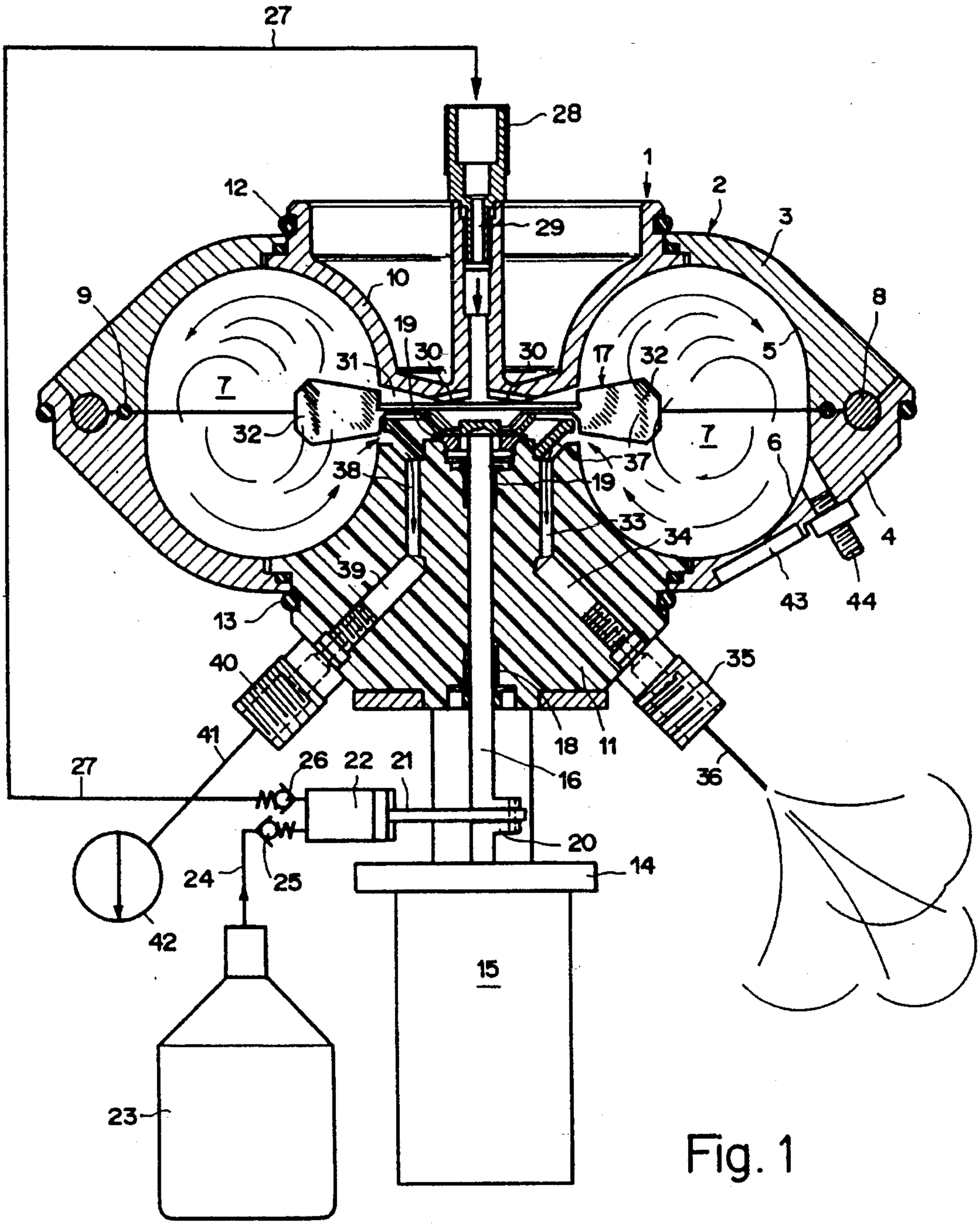

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Fig. 1

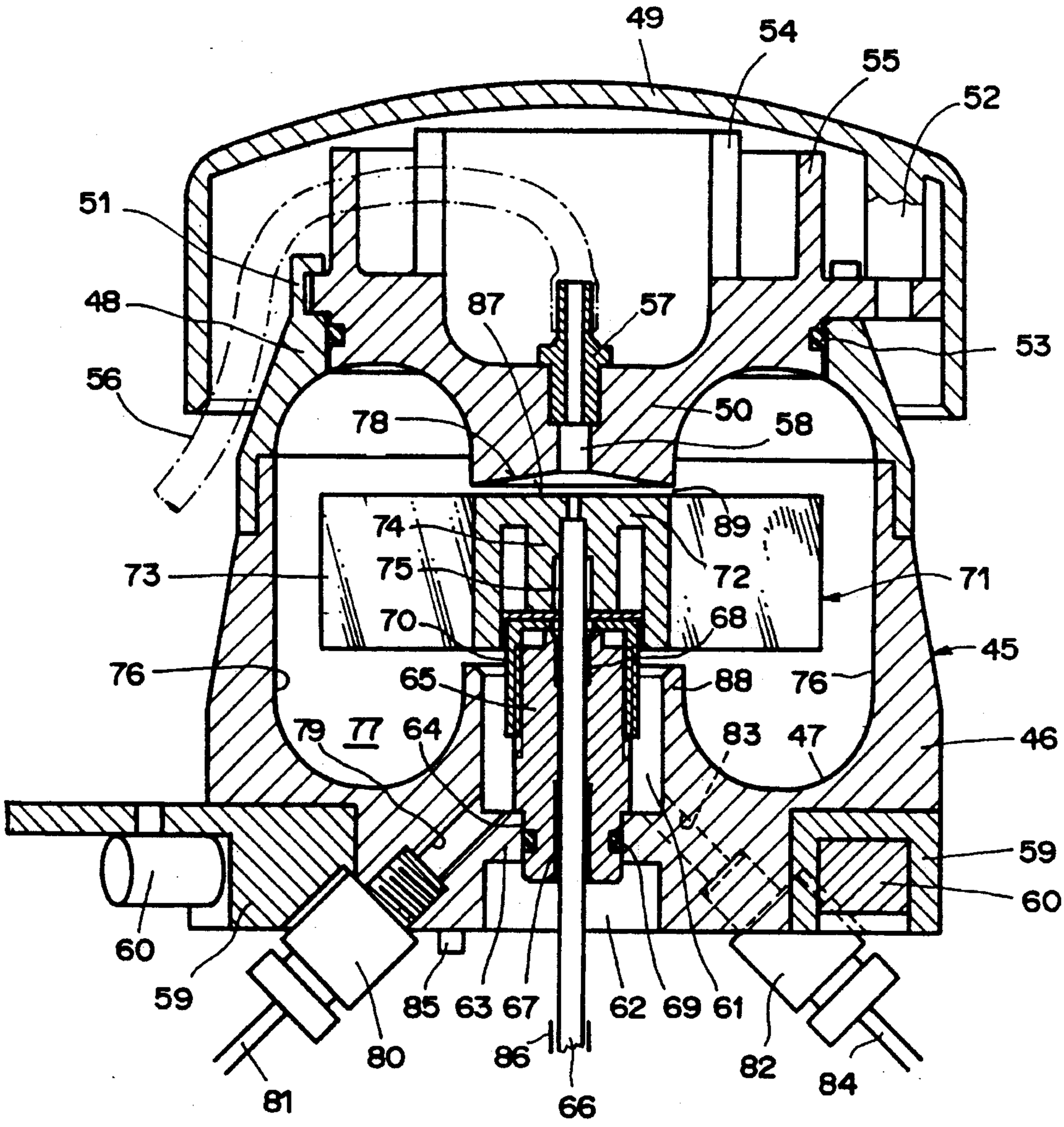
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Fig. 2

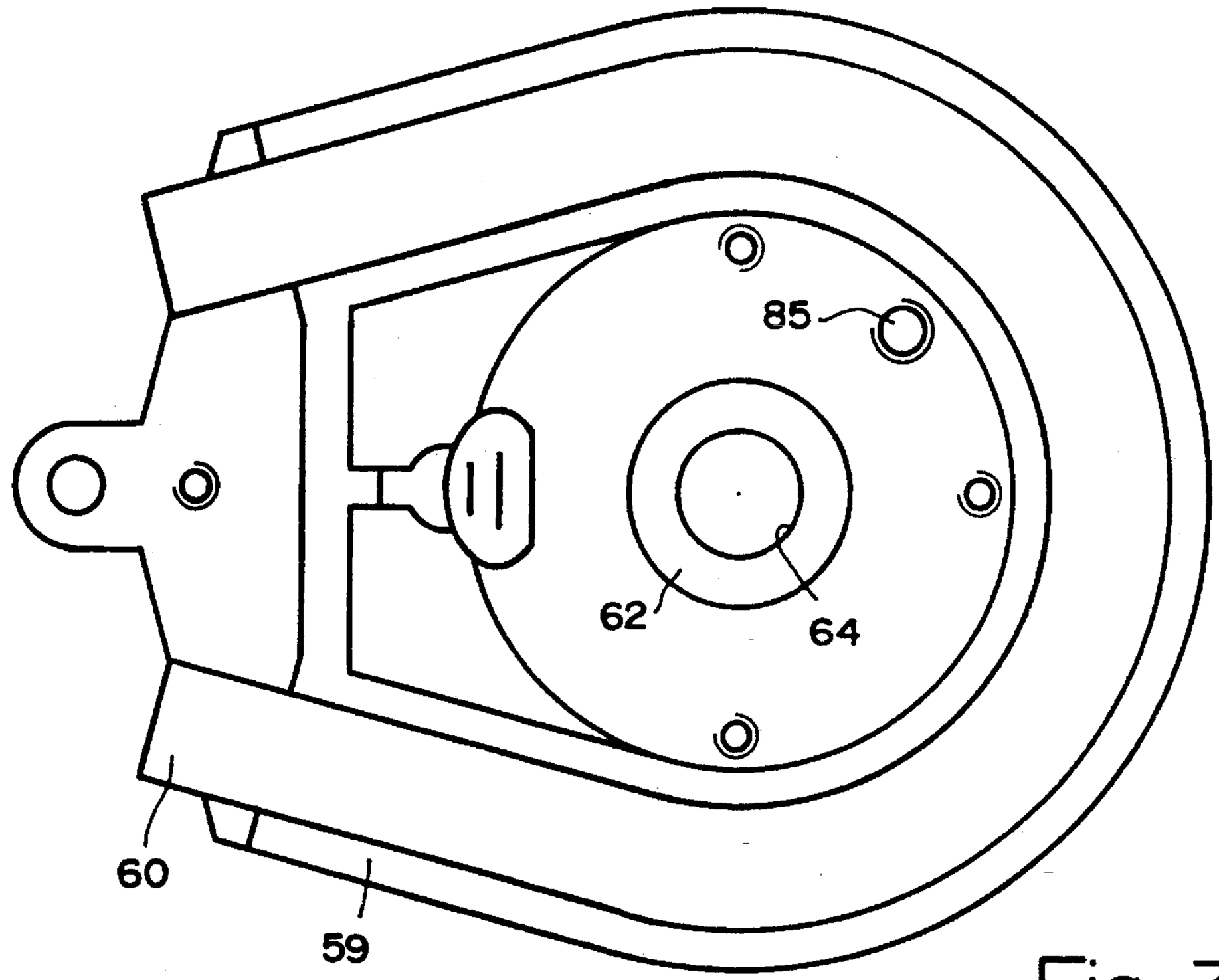

Fig. 3

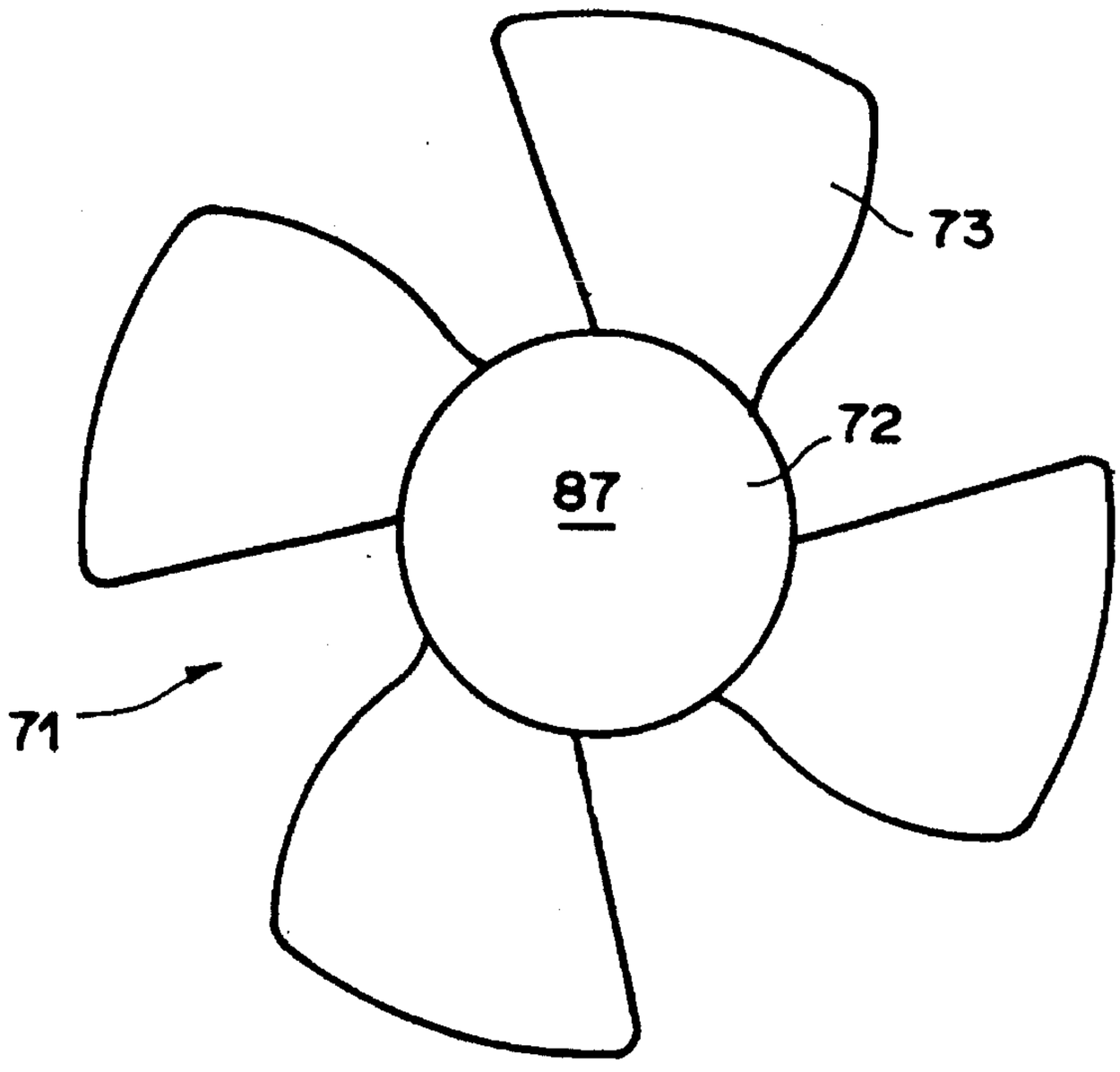

Fig. 4

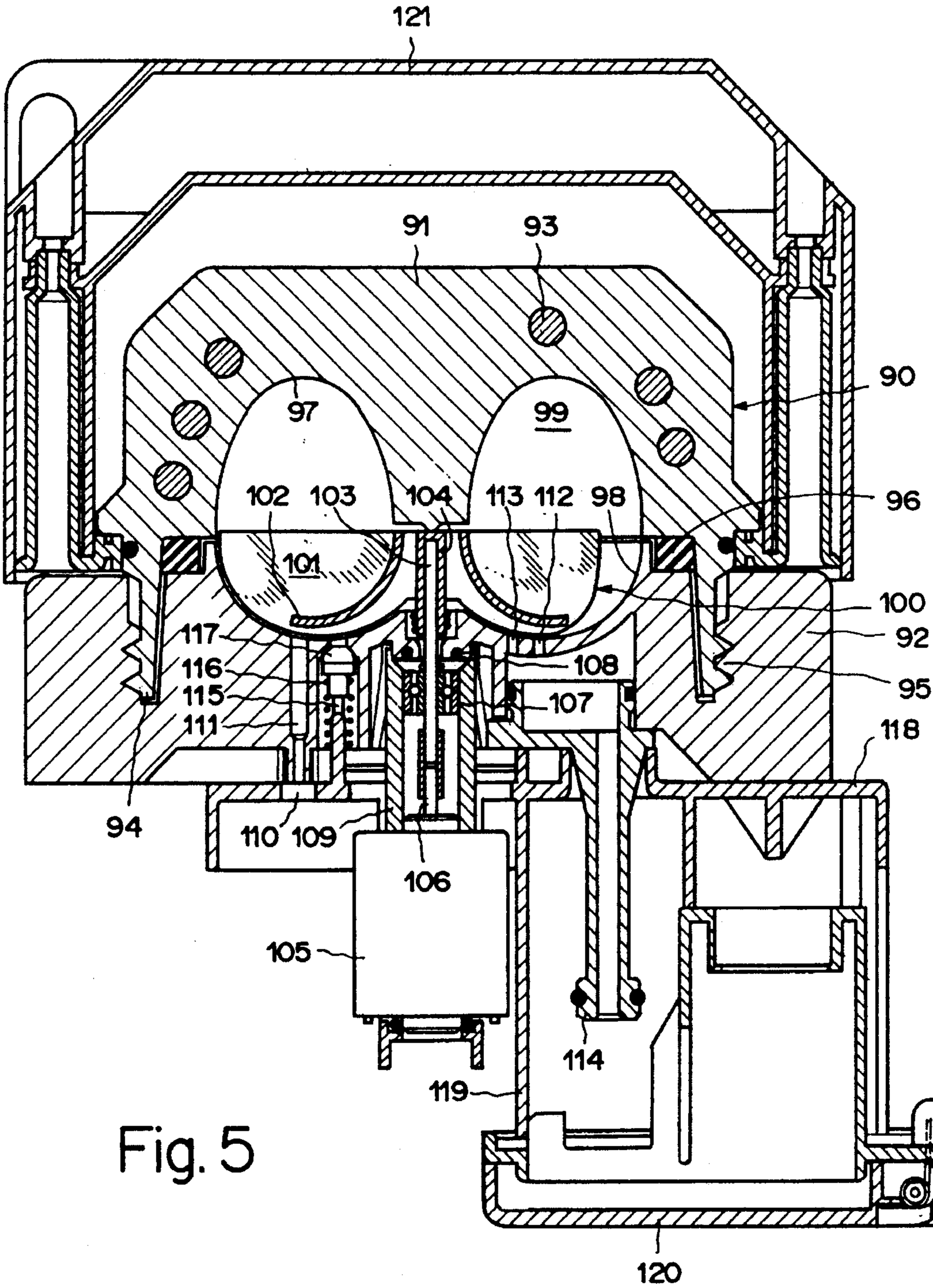
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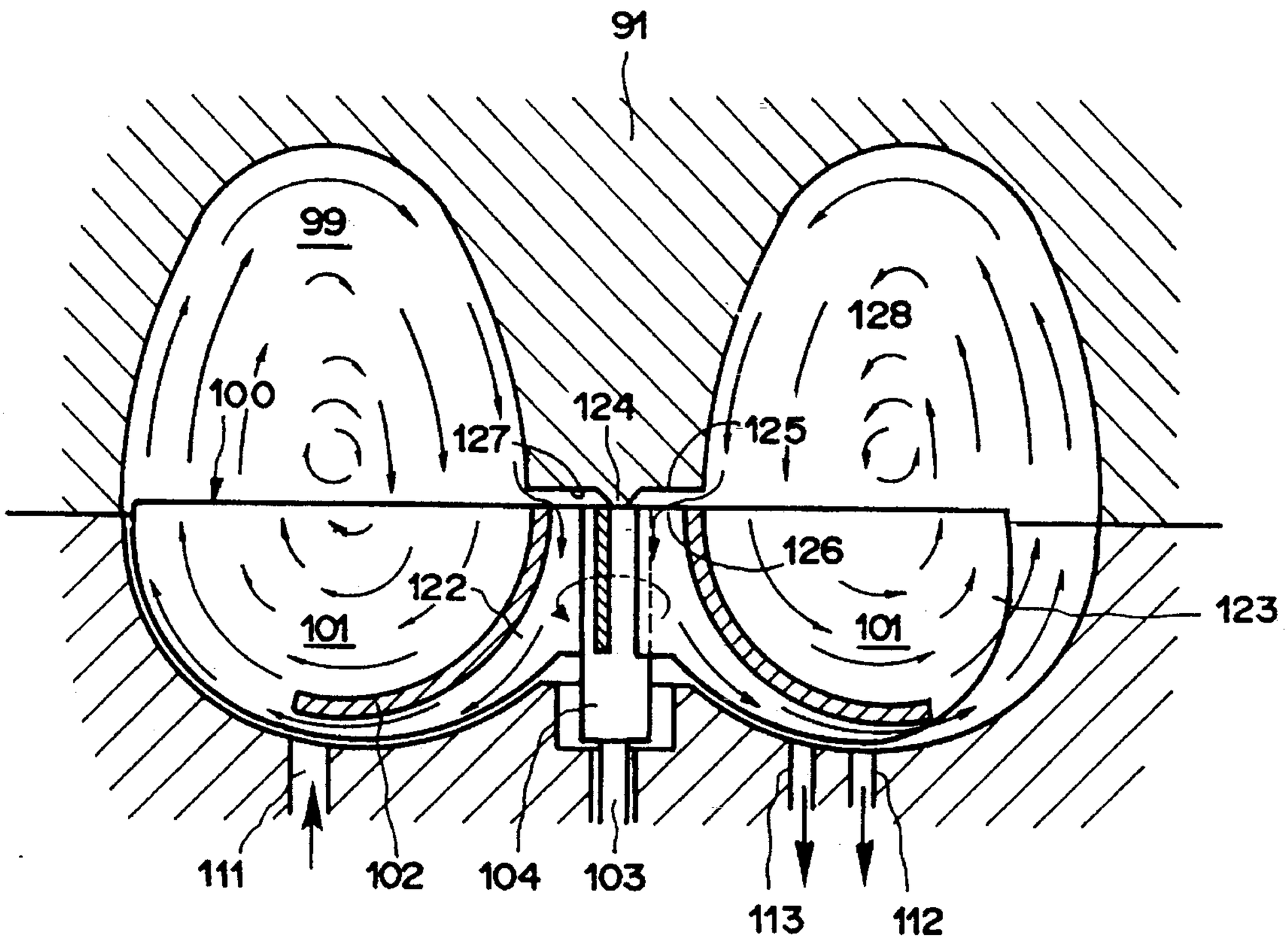
Fig. 5

Fig. 6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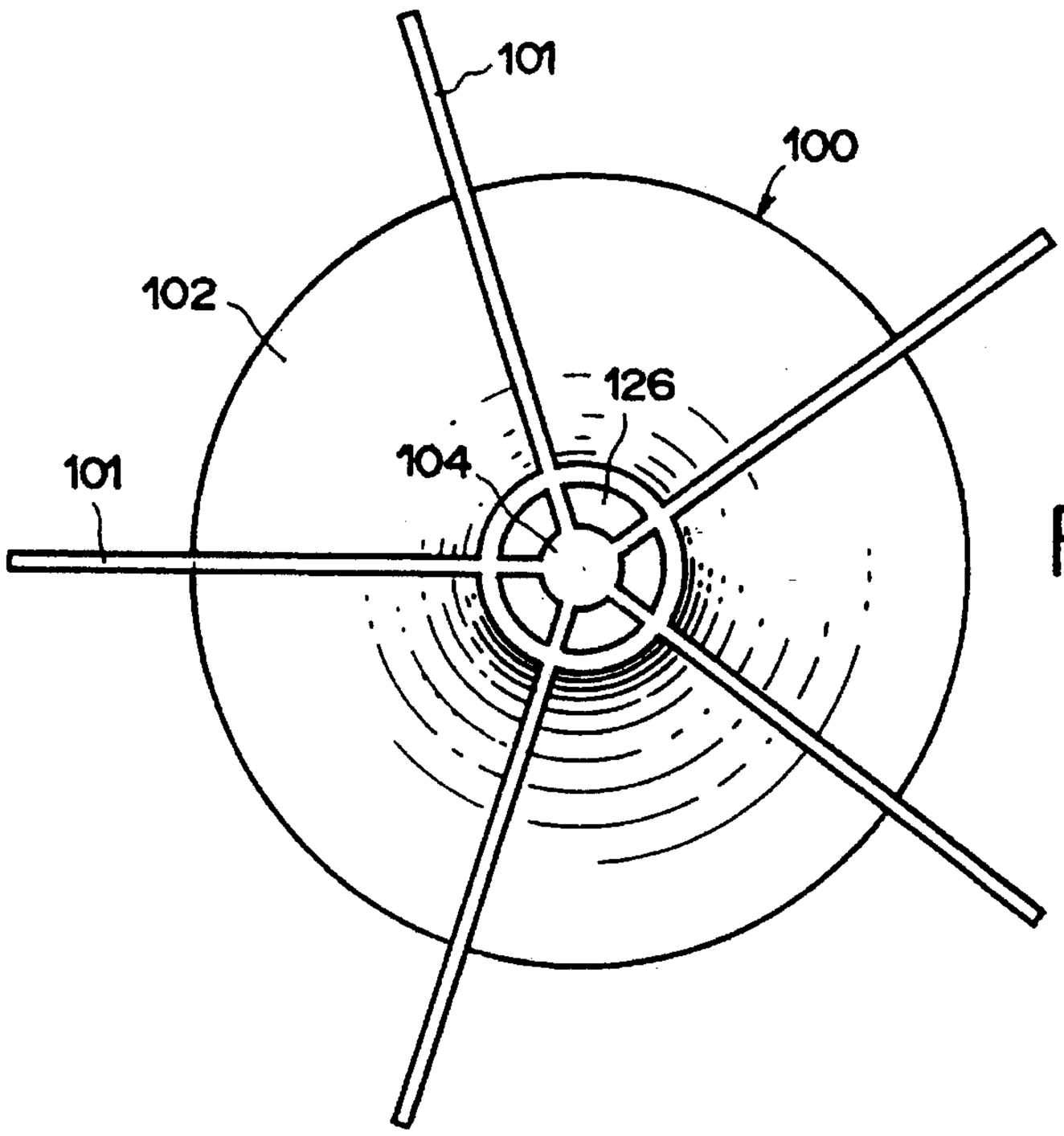
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Fig. 7

STEAM-GENERATING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to devices for producing steam, and more particularly to a steam-generating device of the type having a housing, a steam chamber, a heating arrangement, a water feed line, at least one steam-discharge line, and at least one rotating means disposed in the steam chamber for atomizing the water and for flinging the same against the steam-chamber wall. The invention further relates to an arrangement having such a steam-generating device and intended for an iron used with an ironing-board.

2. Discussion of the Background

In prior art devices for generating steam, the transmission of heat to the droplets of water, and thus the efficiency, are insufficient. Existing devices are very large relative to the steam output.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an improved steam-generating device by means of which the drawbacks of the prior art are avoided and which has greater efficiency than prior art devices.

A further object of the invention is to provide a steam-generating device which generates a very large amount of steam in a small space within a short time.

Still another object of the invention is to provide a steam-generating device whereby scale is deposited largely in the form of powder and well distributed.

To this end, in the steam-generating device according to the present invention, of the type initially mentioned, the wall of the steam chamber is heated at least partially by the heating arrangement, and the steam chamber is annular.

One advantage of the inventive device is that it can be operated in any position.

In the arrangement according to the present invention of the type initially mentioned, the steam-generating device is disposed in the region of the ironing-board, and the steam-discharge line is connected to the iron.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will now be described in detail with reference to the accompanying drawings, in which:

FIG. **1** is an elevation, partially in section, of a steam-generating device in a first embodiment of the invention,

FIG. **2** is a cross-section of a steam-generating device in a second embodiment of the invention,

FIG. **3** is bottom view of a heating means,

FIG. **4** is a top plan view of an impeller,

FIG. **5** is a section through a steam-generating device in a third embodiment of the invention,

FIG. **6** is a section through the steam chamber of the device of FIG. **5**, and

FIG. **7** is a top plan view of the impeller.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a first embodiment of the invention illustrated in FIG. **1**, a steam-generating device **1** has an axially symmetrical body **2** comprising on the outside two contiguous heat shells

3 and **4**, the inside walls **5** and **6** of which bound an annular steam chamber **7**. Disposed at the interface between shells **3** and **4** is a likewise annular heating body **8**, a gasket **9** of temperature-stable material, e.g., silicone, being disposed between body **8** and chamber **7**. Shells **3** and **4** are made of a material which is a good conductor of heat, e.g., aluminum. Adjacent to upper heat shell **3**, as viewed in the drawing, is an upper part **10** of axially symmetrical body **2**, made of a poor conductor of heat, e.g., heat-resistant plastic. Adjacent to lower heat shell **4**, as viewed in the drawing, is a lower part **11**, also made of a poor conductor of heat such as heat-resistant plastic. The two heat shells **3** and **4** plus upper part **10** and lower part **11** surround annular steam chamber **7**, which may be circular, elliptical, oval, or egg-shaped in cross-section. Heat shells **3** and **4**, made of a good conductor of heat, viz., aluminum, conduct the heat from heating body **8** to the wall **5**, **6** of steam chamber **7**.

Body **2** is held together by steel rings **12** and **13**. Via a shaft **16**, an electric motor **15** secured to a flange **14** drives an impeller **17** extending into steam chamber **7**. Shaft **16** is mounted at the bottom in bearings **18** and **19** and at the top on lower part **11**. Via a crank gear **20**, motor **15** drives the piston rod **21** of a cylinder pump **22**. From a water reservoir **23**, pump **22** pumps water through a first line **24** and a first valve **25**, then through a second valve **26** and a second line **27**, to a connection piece **28** on upper part **10** of device **1**. Through a duct **29** in connection piece **28**, the water flows via ducts **30** to the center of the rotating impeller **17** and onto the vanes **32** thereof. The water, atomized into tiny droplets, is flung outward by centrifugal force against the hot wall **5**, **6** of steam chamber **7**, where it is vaporized. The rotation of impeller (fan wheel) **17** generates a turbulent movement of air in the heated steam chamber **7**. The additional air current in chamber **7** augments the uniform distribution of the water on the hot wall of the chamber and brings about optimum exploitation of the thermal energy present, as well as generation of a maximum amount of steam.

The steam is supplied through a space **31**, two bores **33** and **34**, and a coupling **35** via a connecting line **36** to the consuming appliance, e.g., an iron. A plastic part **37** keeps steam from flowing into the region around the end of shaft **16**. Through two bores **38** and **39**, steam is supplied via a connection **40** and a line **41** to a manometer **42**, for example, or to a second consuming appliance. In the case of this steam supply line, plastic part **37** likewise keeps steam from flowing into the region around the end of shaft **16**. A thermostat may be inserted in a recess **43** and secured by means of a fixing screw **44**.

In the second embodiment of the invention illustrated in FIG. **2**, a steam-generating device **45** is also axially symmetrical. It comprises, as viewed in FIG. **2**, a lower part **46** made of a good conductor of heat, e.g., aluminum, having an annular cavity **47**. Next is a middle part **48** which is joined to lower part **46** and is likewise made of a material such as aluminum which conducts heat well. Attached to part **48** by means of a bayonet catch **51** is a cover **49** having an extension piece **50** joined thereto. Cover **49** is made of plastic and extension piece **50** of a poor conductor of heat such as a heat-resistant plastic. Piece **50** is secured to a bolt **52** integral with cover **49**. Disposed along the outer periphery of extension piece **50** is an O-ring which seals it relative to middle part **48**. Facing cover **49** on piece **50** are parts **54** and **55** in the approximate shape of hollow half-cylinders for holding a water supply tube **56** and forming a sort of labyrinth. Tube **56** is connected to an adapter **57** inserted in a bore **58** in extension piece **50**.

Pressed into the bottom of lower part **46** is a heating body **60** provided with a jacket **59** made preferably of aluminum.

A conventional, commercially available heating element is used as the heating body **60**. Lower part **46** according to FIG. **2** is broadened in its middle section **88**, an annular shoulder **63** being provided between upper and lower bores **61**, **62**. A shaft bearing part **65** for mounting a rotary shaft **66** is inserted in the central opening **64** of annular shoulder **63**. Bearing part **65** has two bearings **67** and **68** for mounting shaft **66** and is sealed in annular shoulder **63** by means of an O-ring **69**. Placed on bearing part **65** is a gasket cap **70**, preferably of plastic. An impeller **71** having a middle part **72** and four vanes **73** secured thereto is mounted on shaft **66**. Shaft **66** is inserted in a bore **75** disposed in a central projection **74** of middle part **72**.

In the same manner as in the first embodiment, shaft **66** is driven by a motor via a crank gear. The same motor drives a cylinder pump which conveys water from a flexible water reservoir to a water supply tube **56**. The water conveyed through tube **56** is supplied via adapter **57** and bore **58** to the center of the disk-shaped middle part **72** of impeller **71**, whereupon the rotating middle part **72** flings the water, atomized into tiny droplets, outward against the hot wall **76** of a steam chamber **77** of oval cross-section formed by the inside surfaces of lower part **46**, of middle part **48**, and of extension piece **50**. Only the inside walls of lower part **46** and of middle part **48**, both preferably made of aluminum, are heated. The inside surfaces of plastic extension piece **50** are not heated, or only moderately. At the bottom of piece **50** there are four water injection ducts **78** disposed at right angles to one another.

As in the first embodiment, the vanes **73** of impeller **71** cause a turbulent movement of air in the heated steam chamber **77**. The additional air current in chamber **77** augments the uniform distribution of the water on the hot wall of the chamber and brings about optimum exploitation of the thermal energy present, as well as generation of a maximum amount of steam. The steam is supplied via steam-outlet ring **61** and a duct **79** to a coupling **80** and through a tube **81** to the consuming appliance, e.g., an iron. A second coupling **82** may also be provided, with steam being supplied to it from steam-outlet ring **61** via a duct **83**. From coupling **82**, the steam is conveyed over a line **84** to a manometer or further consuming appliances (not shown). A temperature sensor **85** may additionally be provided on the underside of lower part **46**.

Impeller **71**, disposed at a very short distance **89** from the bottom of extension piece **50**, has two functions, viz., centrifuging the water droplets by means of the disk-shaped surface **87** of the middle part **72** which acts as a centrifuge surface, and acceleration of the air by means of vanes **73**. Drive shaft **66** for impeller **71** is, for example, connected via a coupling **86** to the drive shaft of the motor (not shown).

A flexible plastic recipient is preferably used as the water reservoir (not shown). The advantage of this is that the water reservoir is capable of functioning in any position since atmospheric pressure presses it together, which is not the case for a rigid container if it is upside down, for instance. The steam-generating device is intended to be of a portable design and usable in any position. The device can be controlled by having the pump convey more water or less, and the impeller rotate faster or slower, according to the voltage. Heat can be accumulated on the heated steam-chamber wall **76**, so that a large quantity of steam can be drawn at short notice. The thermal energy can be withdrawn very quickly by the device having an impeller. In a pressure-tank system, the temperature or the pressure would have to be increased to such an extent that this would be critical for the system. Using the present steam-generating device, e.g., for an iron, the steam is drawn pulsatingly, but not under the increased pressure which would be necessary for a conventional pressure tank. In the inventive device, water is supplied virtually at atmospheric pressure, the heat being accumulated in the housing **3**, **4** or **46**, **48**.

Instead of the water recipient, a fixed water connection with a pressure-reduction valve might be used instead, which would also make it possible to use the steam-generating device in any position. The water connection could be opened and closed by means of a magnetic valve.

One advantage of the second embodiment as compared with the first is the removable cover, which makes descaling easier. The inventive steam-generating device can be opened immediately after use since there is no overpressure.

FIG. **3** shows the heating arrangement from below, while FIG. **4** shows the impeller with its middle part having a plane or structured centrifuging surface **87** and the adjoining four vanes **73**. Fewer or more vanes might also be provided.

FIG. **5** shows a section through a steam-generating device **90** in a third embodiment of the invention. Device **90** comprises a heating body **91** and a steam-chamber head **92**. A heating coil **93** is disposed in body **91**, which has a projecting cylindrical rim **94** provided on the outside with a thread **95** by means of which heating body **91** is screwed into steam-chamber head **92**. Body **91** and steam-chamber head **92**, between which a gasket **96** is disposed, constitute the housing for a steam chamber **99** formed by the inside steam-chamber wall **97** of body **91** and the inside steam-chamber wall **98** of steam-chamber head **92**. An impeller **100** is disposed in chamber **99** as a rotary means. Impeller **100** may have five substantially semicircular vanes **101** and a middle part **102**, for example, and is driven via a shaft extension **103**, engaging a hub **104**, by a motor **105** having a shaft **106**. Shaft extension **103** is held by a shaft-support bearing **107** and provided with a shaft-sealing device **108**. Motor **105** is disposed in steam-chamber head **92** by means of a motor bearing spacer **109**.

Water is supplied to steam chamber **99** in the vicinity of vanes **101** via a water connection **110** through a bore **111** in steam-chamber head **92**. Connection **110** may be connected to a pump and the pump to a water reservoir. Bore **111** serves as a water feed. The water is atomized by the rapidly rotating impeller **100** into tiny droplets and reaches the hot steam-chamber wall **97**, **98**, where the droplets are vaporized. The droplets rotate both about the center line of steam chamber **99** and about the drive shaft and its imaginary extension for impeller **100**. The droplets are thereby thoroughly mixed and can evaporate quickly, i.e., a great deal of steam can reach the consuming appliance within a short time. Through two bores **112** and **113** near vanes **101** disposed opposite water-intake bore **111** relative to shaft **103**, **106**, the steam reaches a steam connection fitting **114** and, through a tube connected thereto (not shown), to the consuming appliance. Bores **111**, **112**, **113** are disposed at the broader (cross-sectional) end of steam chamber **99**. Further provided is an overpressure regulator **115** having a spring **116** and a valve ball **117**. A holding plate **118** is joined to a socket **119**, having a hinged lid **120**, for a steam-connection plug (not shown). Double-walled heat insulation **121** is provided over heating body **91**.

FIG. **6** illustrates steam chamber **99** and impeller **100** in detail. In the present case, annular chamber **99** has a somewhat egg-shaped cross-section. Instead, however, it might be circular, elliptical, or oval, for example. Arrows indicate the direction of movement of the water droplets or steam. Curved middle part **102** of impeller **100** divides vanes **101** into a shaft-adjacent part **122** and a shaft-remote part **123**.

Hub **104** of impeller **100** lies on the conical central portion **124** of the middle part **125** of heating body **91**. Between the end face of part **125** and the end region **126** of impeller **100** is a gap through which steam flows from the portion **128** of chamber **99** remote from impeller **100** into the shaft-adjacent part **122** of impeller **100**.

FIG. **7** is a top plan view of impeller **100**.

In the inventive device, cleaning is facilitated by the fact that scale is largely deposited in powder form owing to atomization of the water by the air current and centrifugal force.

Steam can be generated in any position with the inventive device, thus facilitating portable operation. Hence the device can also be used for steam cleaning, for example, in which case the steam-generating device can be slung on. The amount of steam may be continuously regulated via control from the appliance (iron, steam cleaner, etc.).

The stem-generating device may be used, among other things, for an iron. It is then preferably disposed in the area of the ironing board, with a steam-discharge line being connected to the iron.

What is claimed is:

1. A steam-generating device comprising:

a housing which includes a steam chamber having a wall;

a heating means;

a water feed line for providing water into said steam chamber;.

at least one steam-discharge line; and

at least one rotary means disposed in said steam chamber for atomizing water and flinging it against said wall, said wall being at least partially heated by said heating means, and said steam chamber being annular.

2. The device of claim **1**, wherein said rotary means is an impeller.

3. The device of claim **2**, wherein said impeller comprises a plurality of vanes and a center part connected to said vanes and including a centrifuging surface.

4. The device of claim **3**, wherein said vanes are semi-circular.

5. The device of claim **3**, wherein said water feed line opens into said steam chamber in a vicinity of said vanes.

6. The device of claim **3**, wherein said impeller comprises a middle part dividing said vanes into two areas.

7. The device of claim **1**, wherein said steam chamber is axially symmetrical.

8. The device of claim **1**, wherein said means for heating is disposed in a portion of said housing at least partially bounding said steam chamber.

9. The device of claim **1**, further comprising a motor for driving said rotary means and a pump for conveying water into said steam chamber.

10. The device of claim **1**, further comprising a water reservoir, a pump for conveying water from said reservoir into said steam chamber, and a driving motor for driving said pump and said rotary means.

11. The device of claim **1**, further comprising a cover for closing and opening said steam chamber.

12. The device of claim **1**, further comprising a flexible water recipient for supplying said device with water.

13. A steam-generating device comprising:

a housing which includes a steam chamber having a wall;

a heating means;

a water feed line for providing water into said steam chamber;

at least one steam-discharge line;

at least one rotary means disposed in said steam chamber for atomizing water and flinging it against said wall, said wall being at least partially heated by said heating means, and said steam chamber being annular; and

a plurality of water injection ducts disposed in a portion of said housing projecting into a region of said rotary means.

14. A steam generating device comprising:

a body which includes at least one steam chamber having inside walls;

heating means for heating at least the inside walls of said at least one steam chamber;

a rotary impeller rotatably mounted in said body, said rotary impeller having at least one vane which is disposed in said at least one steam chamber; and

water feed means for feeding water to a center portion of said rotary impeller and radially outward onto said at least one vane for atomizing water, such that a rotation of said rotary impeller flings said water against said inside walls heated by said heating means so as to vaporize the water, and the rotation of said rotary impeller causes said at least one vane to generate a turbulent movement of air in said steam chamber to permit a uniform distribution of water on the heated inside walls.

* * * * *